Registration No. : | | | | | | | | | | |

Total number of printed pages – 3

B. Tech

HSSM 3302

Sixth Semester Regular Examination – 2015

OPTIMIZATION IN ENGINEERING

BRANCH (S) : AUTO, CIVIL

QUESTION CODE : J 484

Full Marks – 70

Time : 3 Hours

*Answer Question No. 1 which is compulsory and any **five** from the rest.*

The figures in the right-hand margin indicate marks.

1. Answer the following questions : 2×10

   (a) What are the functions of surplus and artificial variables in a LPP.

   (b) Obtain the dual problem of the following primal LP problem

   Maximize $Z = 3x_1 + 2x_2 + x_3$

   Subject to $2x_1 + 3x_2 \geq 2$

   $x_1 + x_2 + x_3 \geq 1$

   $5x_1 + 2x_2 - 3x_3 \leq 6$

   $x_1, x_2, x_3 \geq 0$

   (c) Write the basic steps in constructing a Linear Programming model.

   (d) Differentiate between transportation problem and transhipment problem.

   (e) What is the importance of sensitivity analysis ?

   (f) What are the basic characteristics of a queuing system ?

   (g) What is inter-arrival time in a queueing system. What is MM1 queuing model ?

   (h) Explain the concept of Fibonacci search method.

   (i) Define Hessian matrix, gradient vector.

   (j) Explain queuing model.

2. (a) Solve the following LPP using Simplex method : 5

   Minimize $Z = -3x_1 - 2x_2$

   subject to $2x_1 + 3x_2 \geq 30$

   $3x_1 + 2x_2 \leq 24$

   $x_1 + x_2 \geq 3$

   $x_1, x_2 \geq 0$

P.T.O.

(b) Use duality to solve the following LPP 5

Maximize $Z = 2x_1 + x_2$

Subject to $x_1 + 2x_2 \leq 10$

$x_1 + x_2 \leq 6$

$x_1 - x_3 \leq 2,$

$x_1 - 2x_2 \leq 1$

$x_1, x_2 \geq 0$

3. Consider the following LPP : 10

Maximize $Z = 5x_1 + 12x_2 + 4x_3$

Subject to $x_1 + 2x_2 + x_3 \leq 5$

$2x_1 - x_2 + 3x_3 = 2$

$x_1, x_2, x_3 \geq 0$

(i) Solve the LPP using Big-M method.

(ii) Discuss the effect of changing the requirement vector from $\begin{bmatrix}5\\2\end{bmatrix}$ to $\begin{bmatrix}7\\2\end{bmatrix}$ on the optimum solution.

(iii) Which resource should be increased and by how much to achive the best marginal increase in the value of the objective function ?

4. Using Revised simplex method solve the following LPP : 10

Minimize $Z = 3x_1 + 2x_2 + 5x_3$

subject to $x_1 + 2x_2 + x_3 \leq 430$

$3x_1 + 2x_3 \leq 460$

$x_1 + 4x_2 \leq 420$

$x_1, x_2, x_3 \geq 0$ 5

5. (a) Solve the following Transportation problem :

Source/Destination	D1	D2	D3	D4	Supply
S1	270	230	310	690	100
S2	100	450	400	320	80
S3	300	540	350	570	80
Demand	60	120	50	40	

(b) Four machines are available to assign four jobs. The following table gives the profit in Rs . Find the assignment of machines to the job that will result in maximum profit. 5

Machines/jobs	A	B	C	D	
1	5	7	11	6	
2	8	5	9	6	
3	4	7	10	7	
4	10	4	8	3	

6. Using Golden section search method, 10

Minimize $f(x) = 4x\sin x$, $\pi \geq x \geq 0$, taking $\in = 0.10$

7. Solve the following problem using the projected gradient method 10

Minimize $z = 16(x_1 - 2x_2)^2 + (x_1 - 2)^2$

Subject to $x_1 + 2x_2 = 8$

8. Solve the following non-linear programming problem using Kuhn-Tucker conditions. 10

Maximize $Z = 8x_1 + 10x_2 - x_1^2 - x_2^2$

Subject to $3x_1 + 2x_2 = 6$

$x_1 , x_2 \geq 0.$